UIC Conference 2025 High Speed Lines Telecoms Requirements
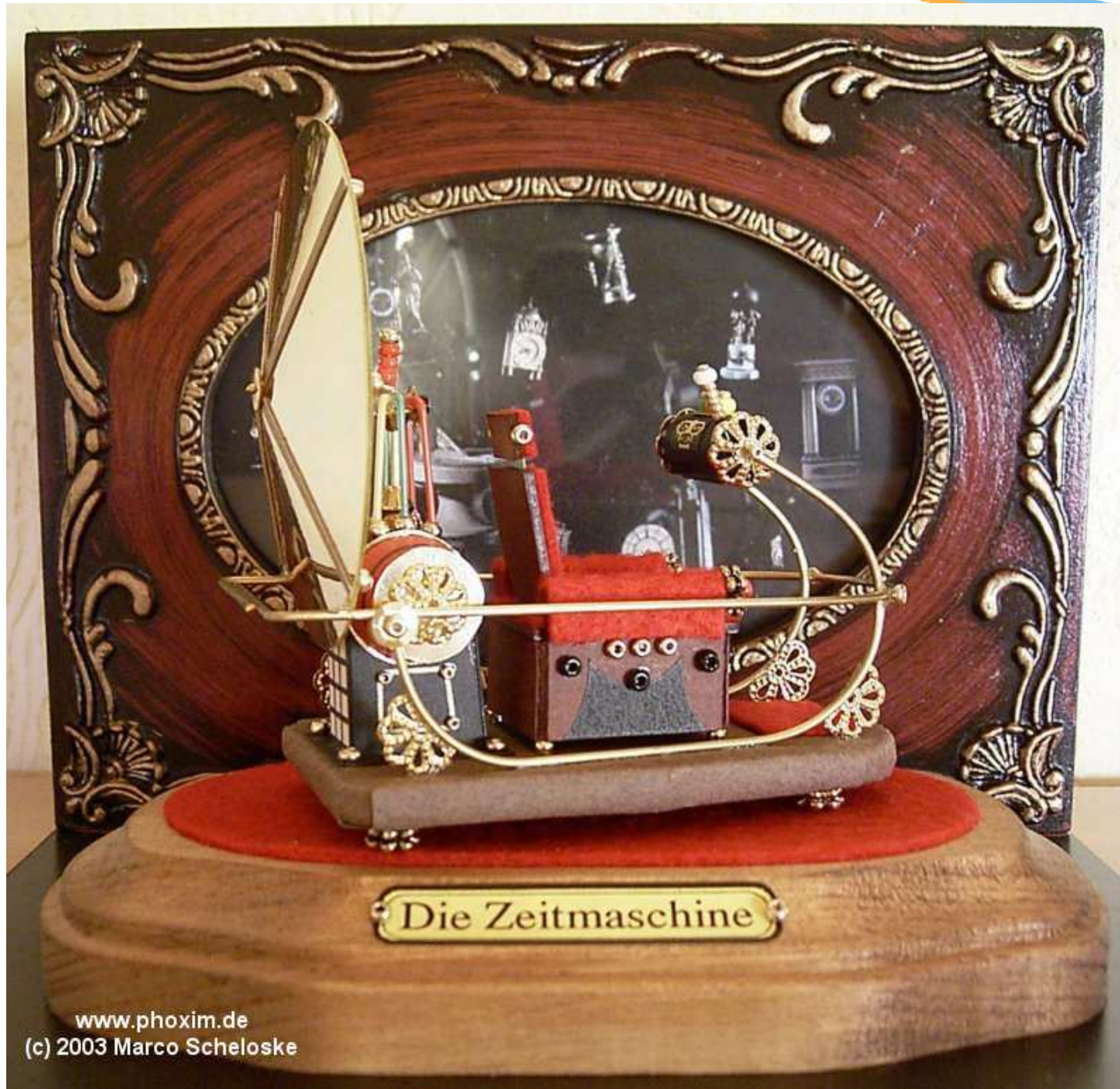
Trevor Foulkes M.A., C.Eng, FIRSE, FIET

Head of Signalling & Telecommunications

Die Zeitmaschine

www.phoxim.de
(c) 2003 Marco Scheloske

hs2 engine for growth

Agenda

1. Describe an example of an High Speed Line
2. Characteristics of radio
3. What stops us getting there
4. Suggestion on approach to approval

HS2 Scope

Two phases - first live 2026

Trains transition to and from Network Rail & HS1

Max speed 360kph

Scheduled every 3 mins

Technical Headway 135s

ETCS Level 2 – no signals

High reliability

Automatic Train Operation
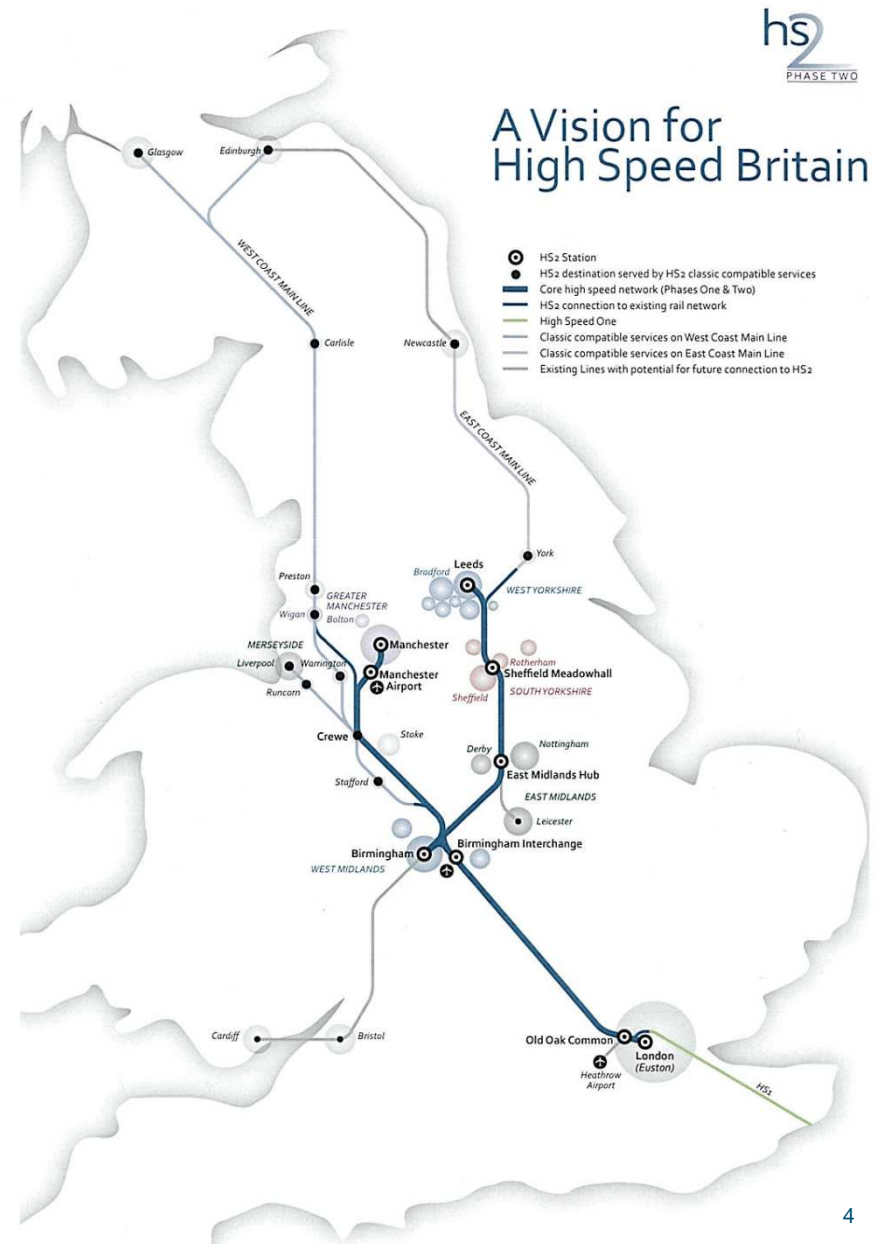
Engineering characteristics

- Geography : mixed landscape – urban and rural. Many sections (about half) are in tunnels.

- 400m trains with about 1000 passengers each

- Some trains dedicated to new HS2 lines, other transition on to Network Rail lines

- ETCS Level 2

- Needs to be very reliable

# Mitigation between railway and property: Landscape earthworks
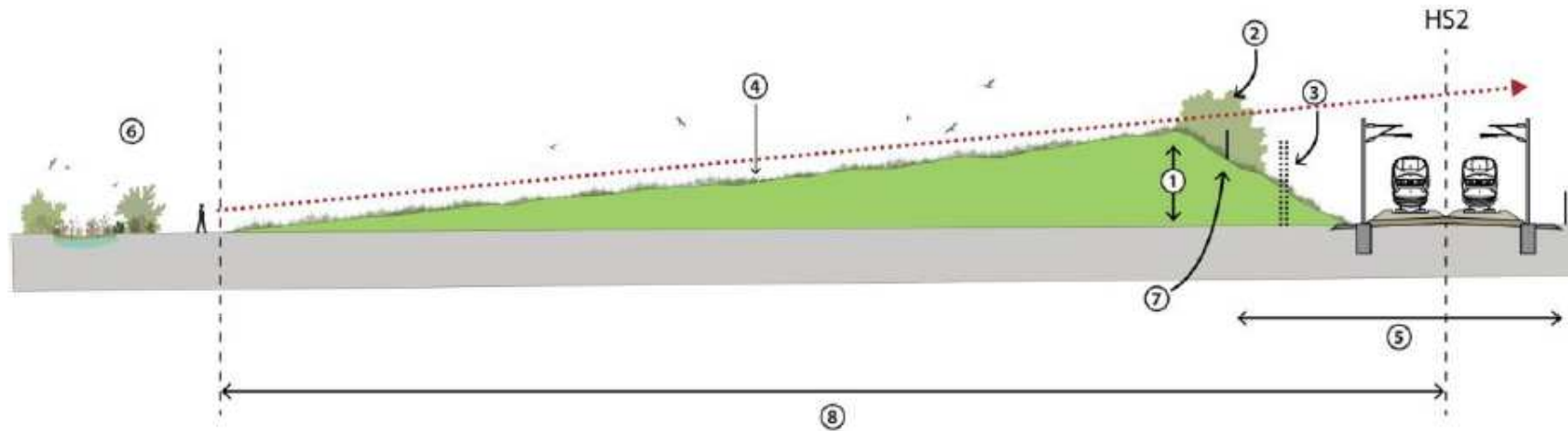
1. Build in visual screening (earthworks)

2. Used in combination with planting for effective screening
3. In rural sections - use earthworks to minimise noise barrier height or use
4. Use appropriate gradients to allow land to be returned to former use (e.g. 1:13 arable, 1:8 livestock)
5. Minimise HS2 width and reduce land take and long term maintenance by allowing land use up to the railway corridor.
6. Earthwork proposals to take into account current land use; designated landscapes; sensitive environments; ecological and archaeological areas etc
7. Conceal railway fencing within earthworks and apply screening treatments
8. Need to include land required (temporary or permanent) to deliver landscape proposal.
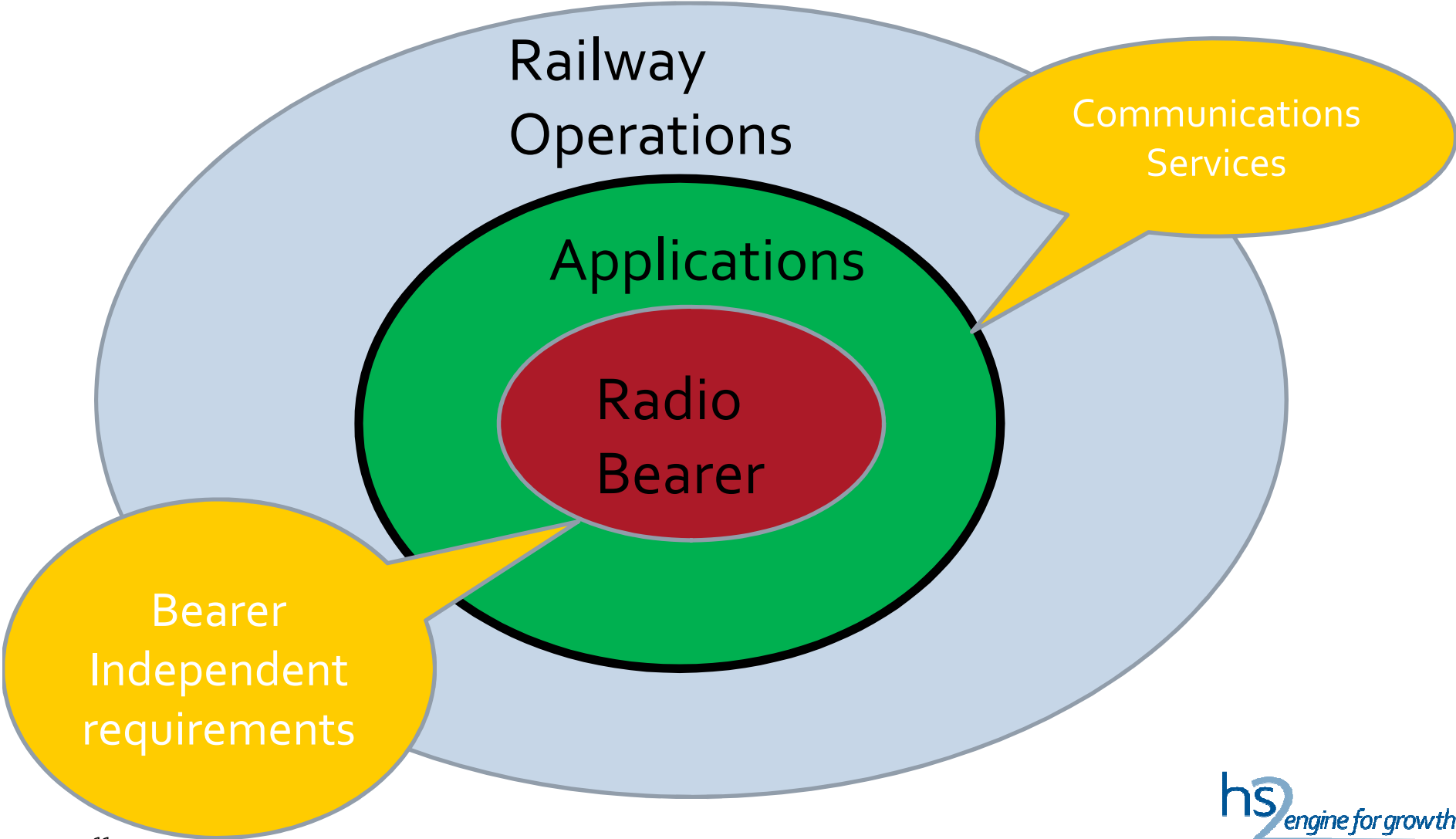
S&T Concept design
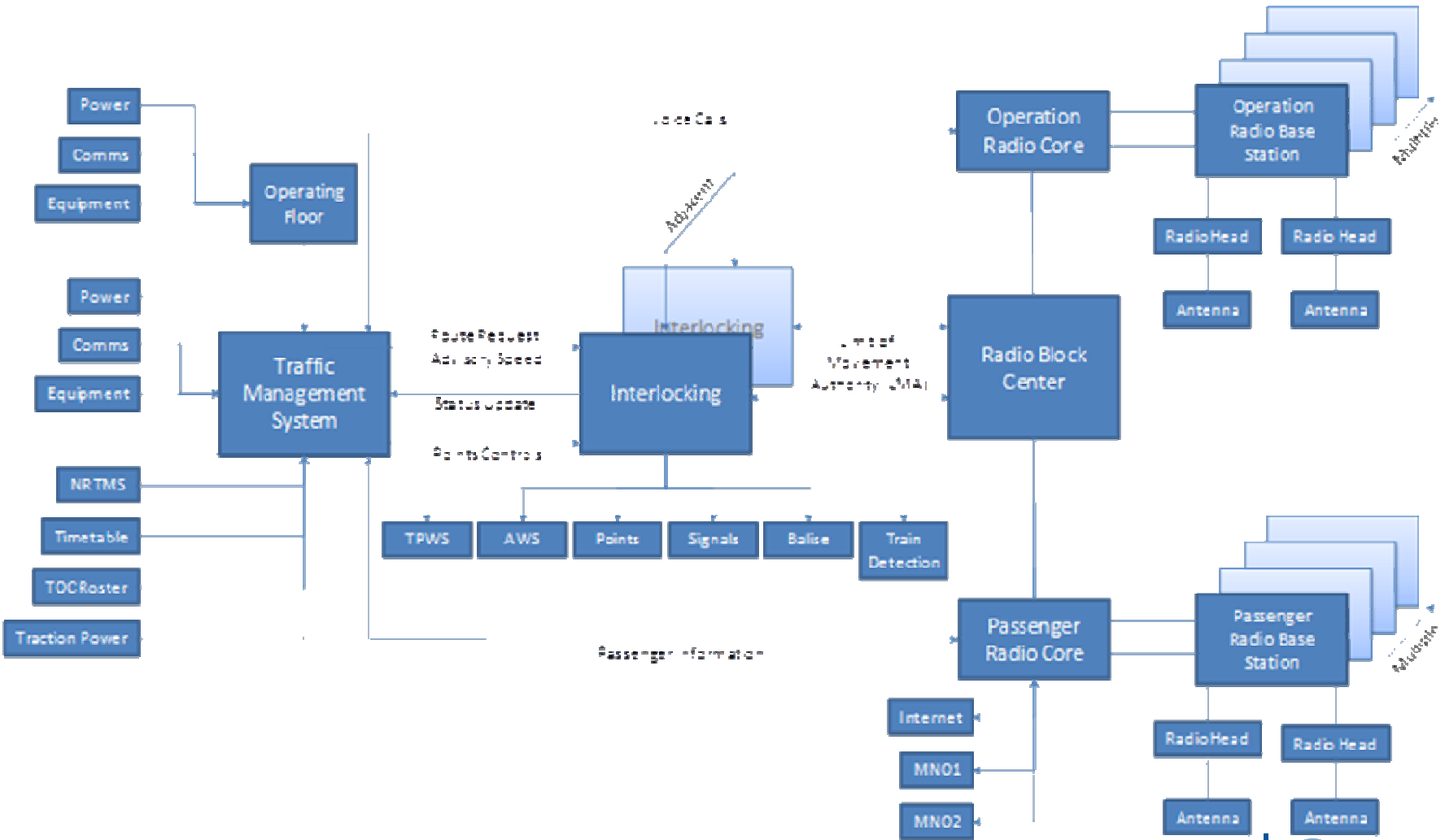
S&T Concept design
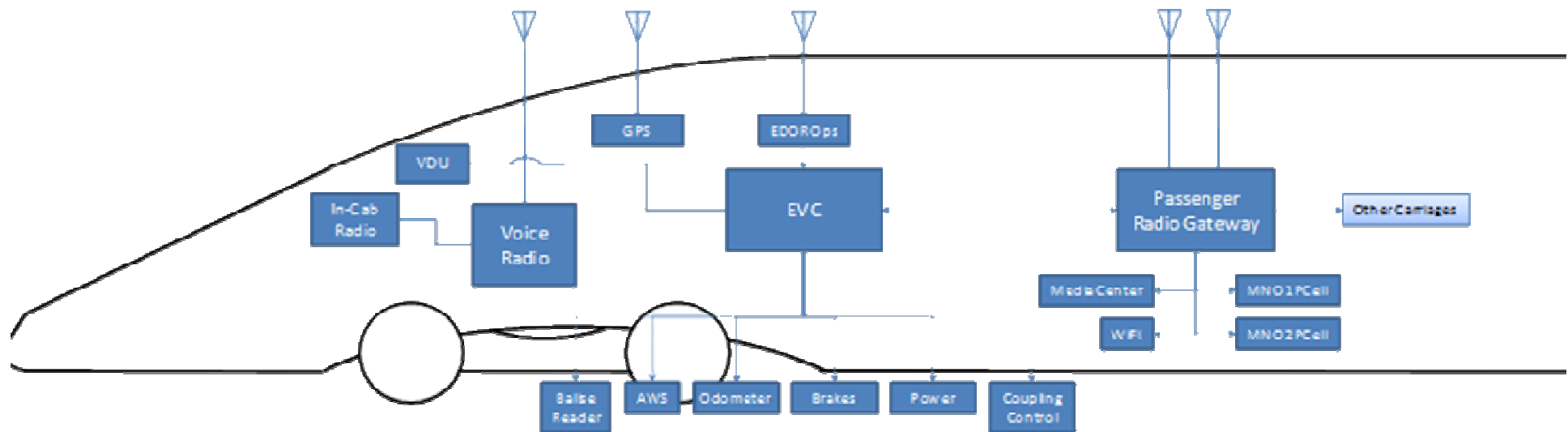
Agenda

1. Describe an example High Speed Line
2. Characteristics of radio
3. What stops us getting there
4. Suggestion on approach to approval

hs2 engine for growth

Communications Service Requirements

- Split user functionality away from the radio network
- Radio network supports many applications and provides robust bearer service along the track
- Applications then developed to use a selection of possible bearer systems:
  - ETCS
  - Voice Communications for driver
  - Telemaintenace
  - Forward facing cameras
  - Passenger wifi
  - Passenger information systems, etc
- Some applications we agree are mandatory for interoperability, most are not.

Split of Bearer and Application

Railway Operations

Applications

Radio Bearer

Communications Services

Bearer Independent requirements

hs2 engine for growth

Typical Radio Bearer Service Requirements

- Supports required applications
- High Reliability
- Reasonable price to buy and own
- No need for regular patches or updates - Works out the box for next 20 years!
- Does not require highly skilled people to look after it
- Uses frequencies which are cheap and not interfered with
- Can use existing masts

- Train equipment needs to interface with the radio bearer used along its route. They could be different in different countries or parts of countries.

Typical Application Service Requirements

- Need to meet the operational need of the Railway

- Define end to end functionality

- Need to define use of common standard services in the radio bearer

- Need to define characteristics which a valid radio bearer system need to meet

- Does not place safety requirements on the bearer network

Agenda

1. Describe an example High Speed Line

2. Characteristics of radio

3. What stops us getting there

4. Suggestion on approach to approval

hs2 engine for growth

Barriers to new radio system

1. TSI Mandates only system to be GSM-R
2. UIC band full and being interfered with
3. Technology refresh makes it difficult to see a long way into the future
4. Approval timescales
5. Business case for renewal
6. Spectrum costs

hs2 engine for growth

Agenda

1. Describe an example High Speed Line
2. Characteristics of radio
3. What stops us getting there
4. Suggestion on approach to approval
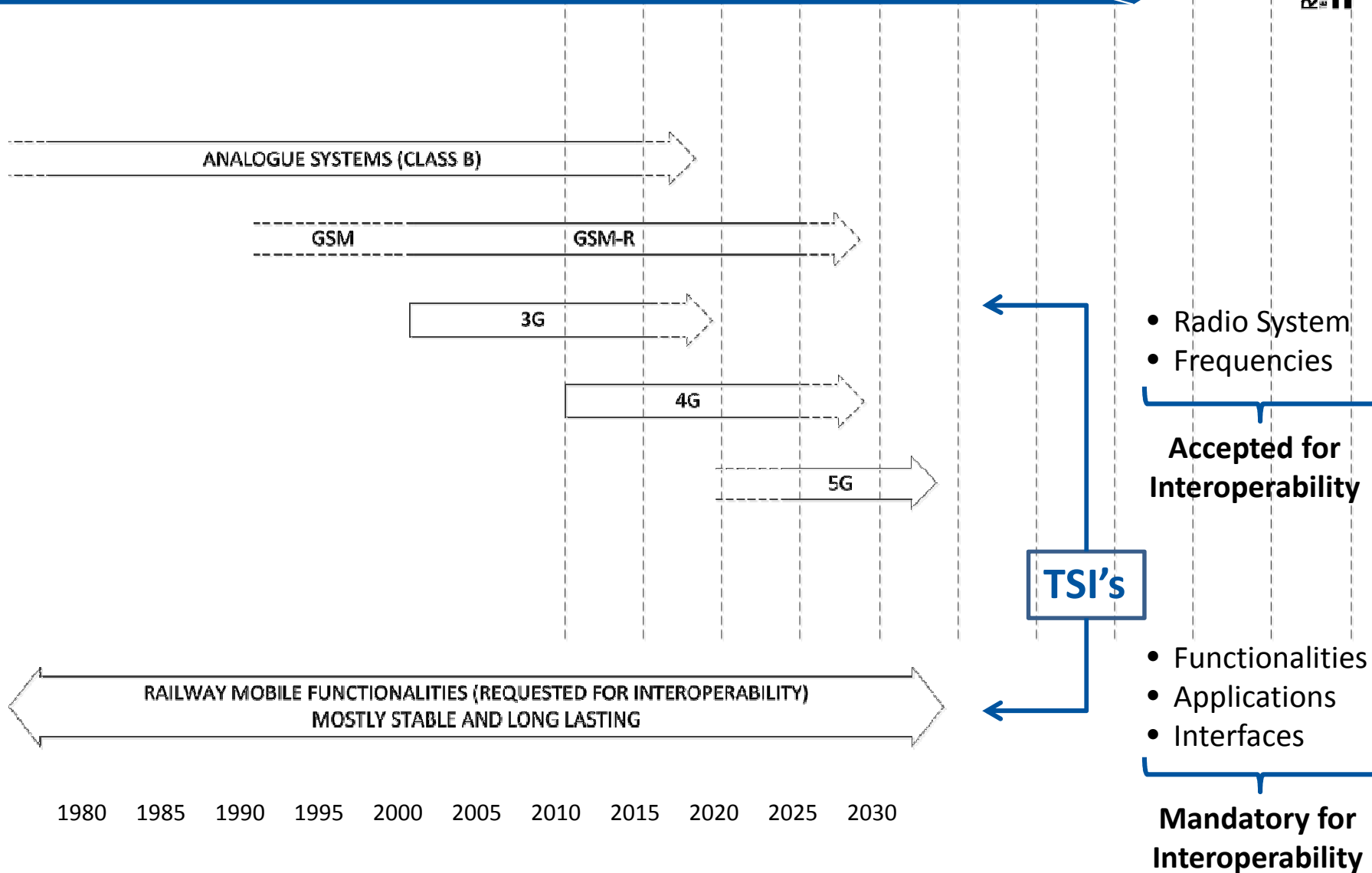
Application

Infrastructure   Mobile

ETCS RBC ⊣   ⊢ ETCS EVC

Voice
Dispatcher ⊣   ⊢ Voice Driver
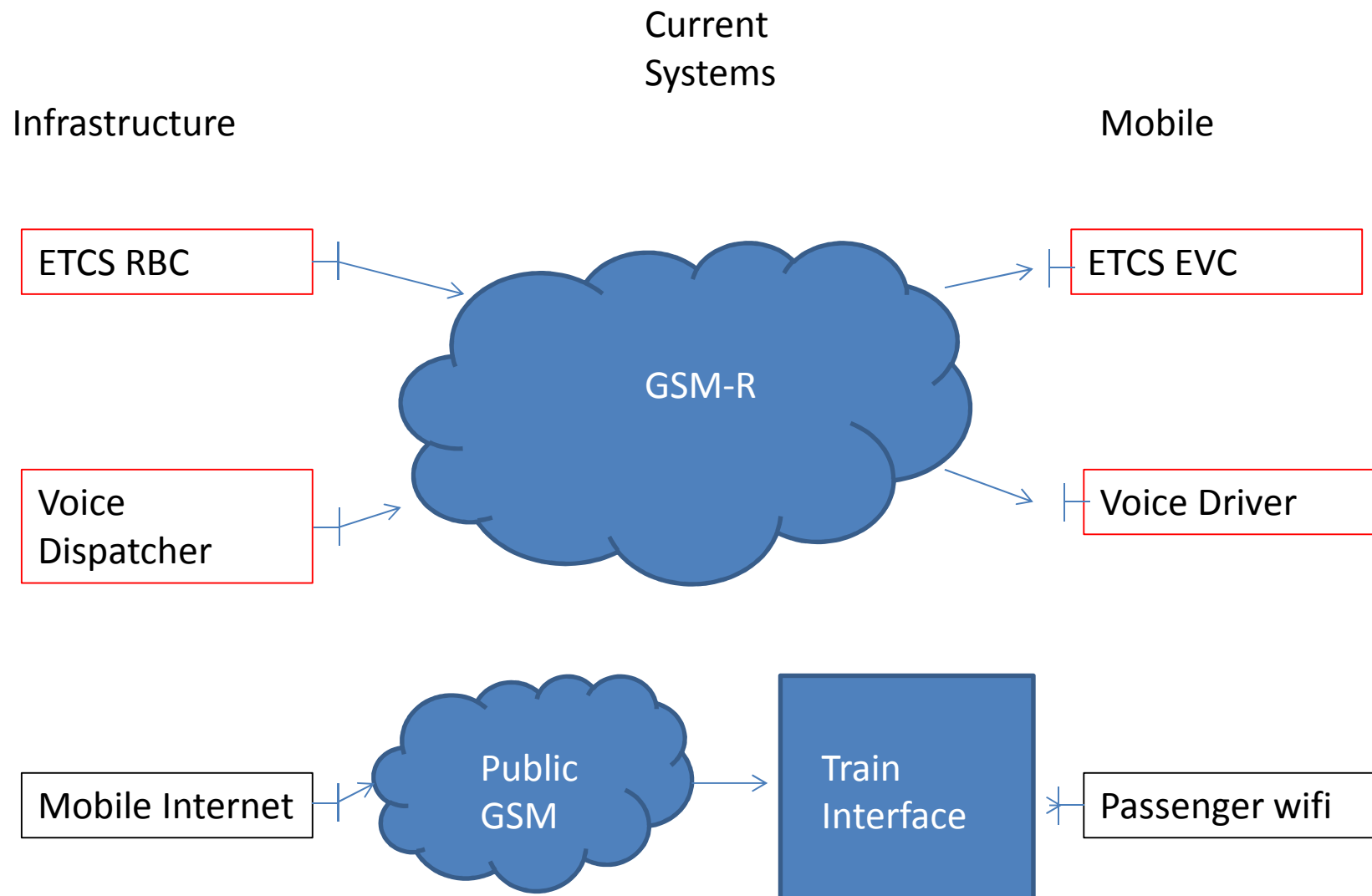
Mobile Internet ⊣   ⊢ Passenger wifi

Applications have defined end to end and sometime one to many
functionality with a defined protocol and required Quality of Service at
the interface. Some are mandated as Interoperable

Current Systems

Infrastructure

Mobile

ETCS RBC

GSM-R

ETCS EVC

Voice Dispatcher

Voice Driver

Mobile Internet

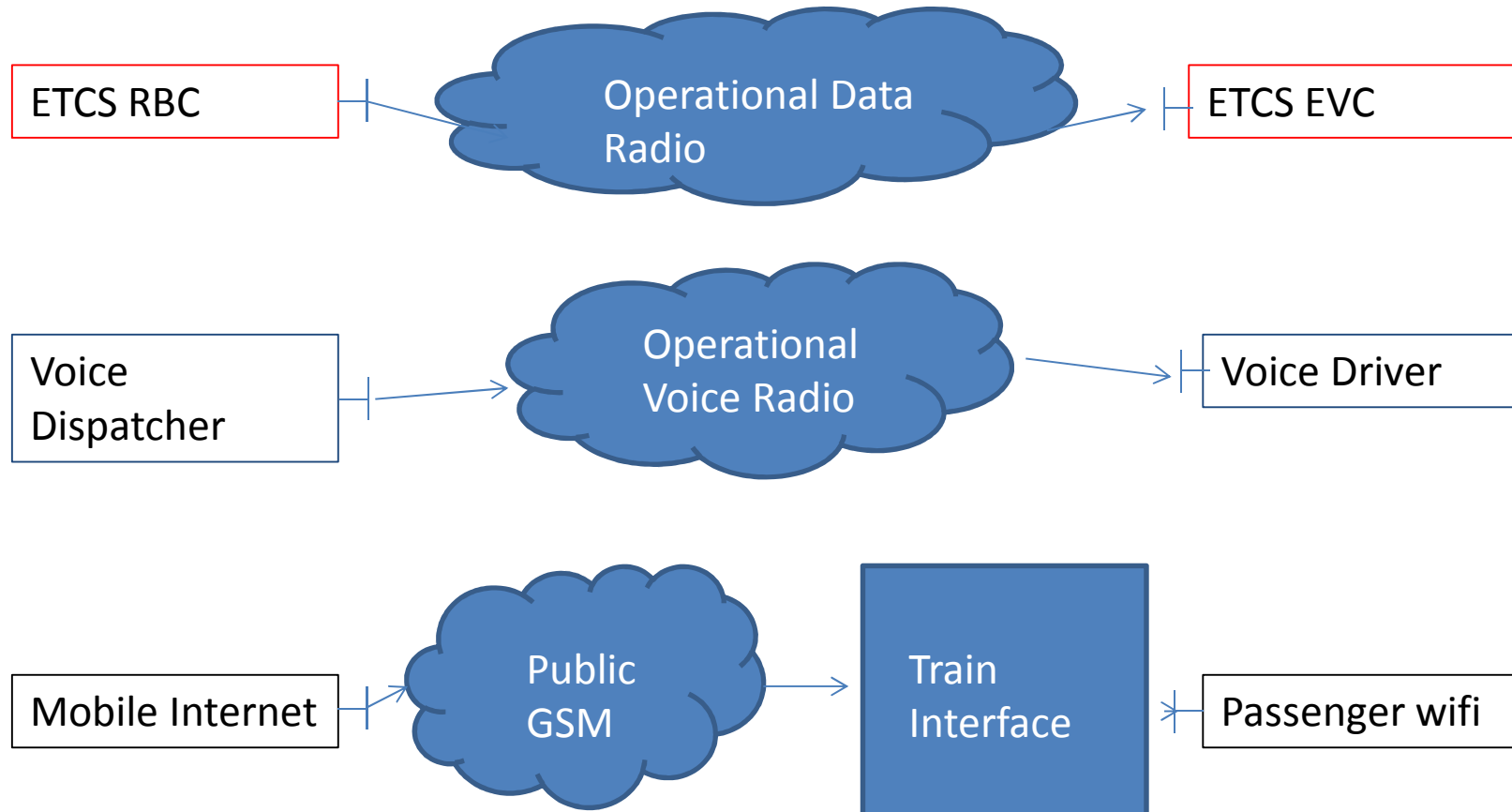Public GSM

Train Interface

Passenger wifi

Current solutions use GSM-R for ETCS and voice and public GSM (or satellite) for passenger comms. GSM-R is allowed under Interoperability to support operational data and voice.

Future System Option 1

Infrastructure   Mobile

ETCS RBC ──────── Operational Data Radio ──────→ ETCS EVC

Voice Dispatcher ──────→ Operational Voice Radio ──────→ Voice Driver

Mobile Internet ──→ Public GSM ──────→ Train Interface ──→ Passenger wifi
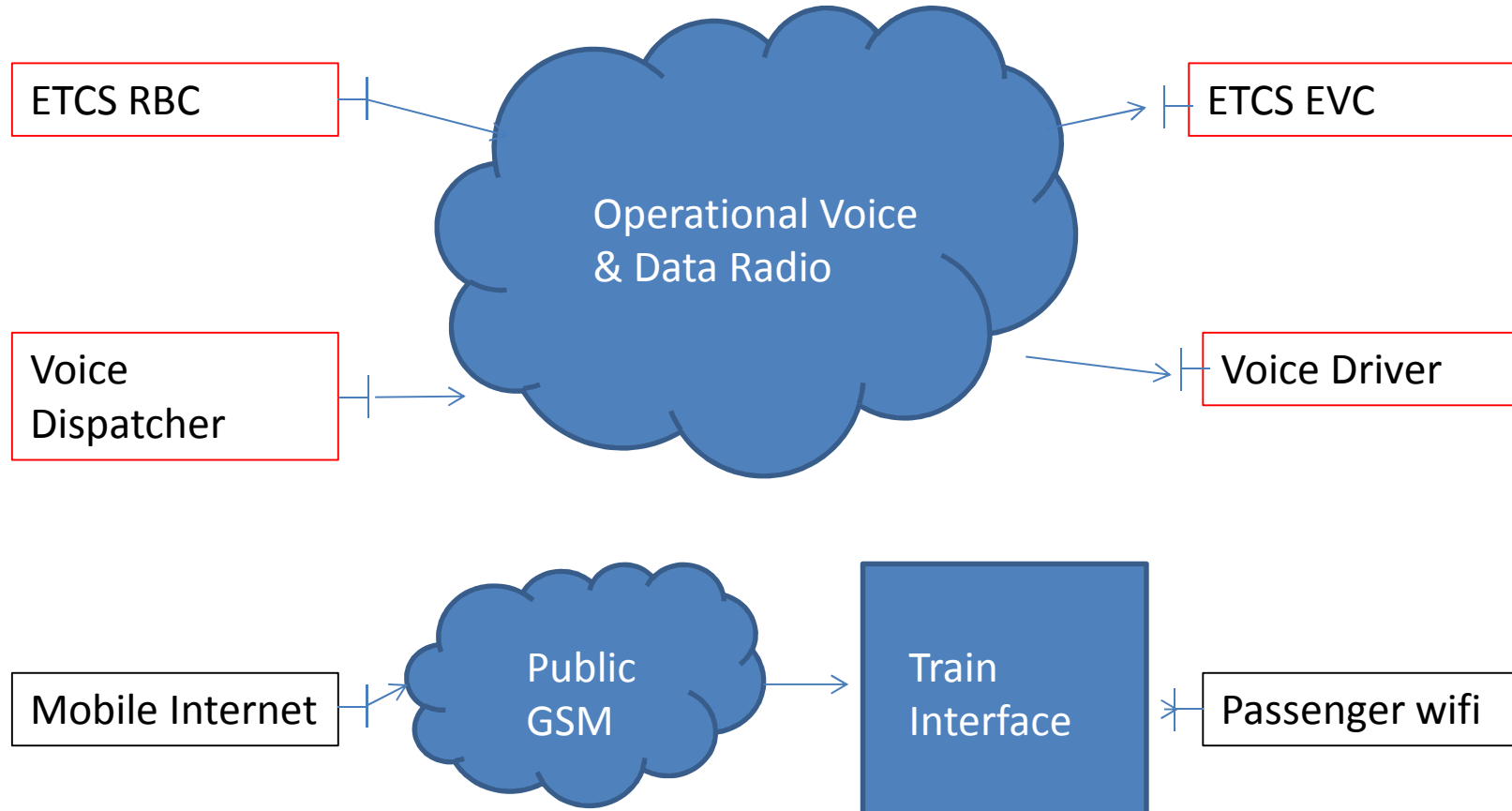
In future could optimize radio solution for each application and then allow ones with support operations under Interoperability

Future System Option 2
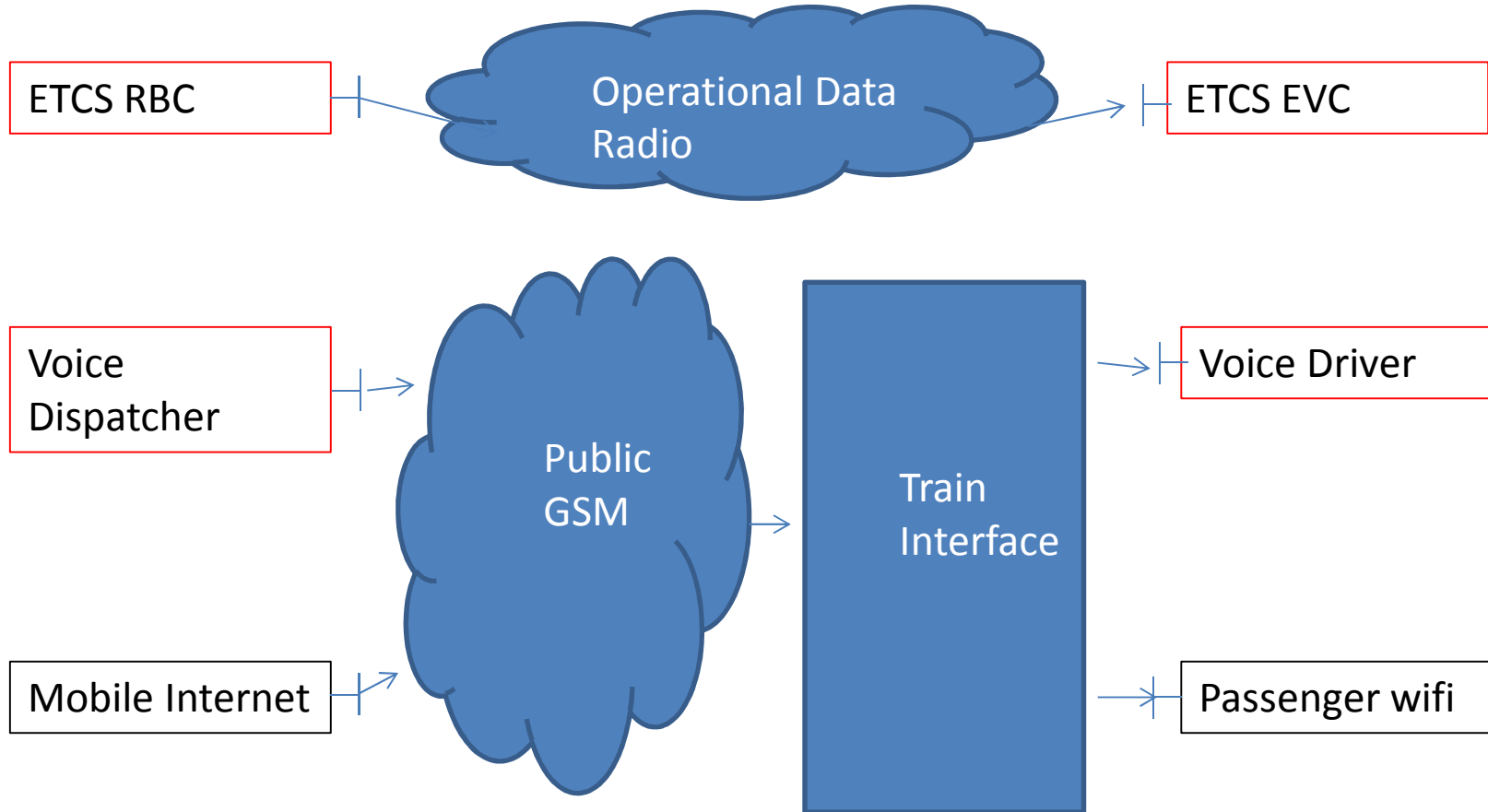
Infrastructure

Mobile

ETCS RBC

Operational Voice & Data Radio

ETCS EVC

Voice Dispatcher

Voice Driver

Mobile Internet

Public GSM

Train Interface

Passenger wifi

Or we could allow a radio solution to support more than one application.

Future System Option 3

Infrastructure   Mobile

ETCS RBC ⊢──→ Operational Data Radio ──→⊢ ETCS EVC

Voice Dispatcher ⊢──→ Public GSM ──→ Train Interface ──→⊢ Voice Driver

Mobile Internet ⊢──→   ──→⊢ Passenger wifi

Or could group another way

Approval process

- We need to mandate the applications, interfaces and required network Quality of Service. Specify some as Mandatory for Interoperability

- Then be able to use any radio solutions that meets the requirements of one or more applications.

- For those radio solutions that support Interoperable Applications, Certify them as allowed to support the applications.

Implications

- Development no longer stagnated
- Could have more than one radio solution certified for each application.
- Each train would need to be fitted with radio solution for the areas it operates in.
- Allows for technology refresh
- Allows railways to choose the best solutions for their circumstances

Thank you for listening

Any questions?

hs2 engine for growth